

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



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Applicant's or agent's file reference IPB/128681	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK 02/00816	International filing date (day/month/year) 03.12.2002	Priority date (day/month/year) 04.01.2002
International Patent Classification (IPC) or both national classification and IPC B01D63/12		
Applicant UNIQ FILTRATION TECHNOLOGY AS et al.		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 6 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

- This report contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application

Date of submission of the demand 24.07.2003	Date of completion of this report 04.03.2004
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK 02/00816

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-20 as originally filed

Claims, Numbers

1-11 received on 22.12.2003 with letter of 18.12.2003

Drawings, Sheets

1/12-12/12 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-11
	No: Claims	
Inventive step (IS)	Yes: Claims	1-11
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-11
	No: Claims	

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/DK02/00816

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

- D1: WO 02 051529 A (DSS DANISH SEPARATION SYSTEMS ;LARSEN KNUD VERNER (DK)) 4 July 2002 (2002-07-04)
D2: US-B1-6 224 767 (FUJIWARA KOJI ET AL) 1 May 2001 (2001-05-01)
D3: US-A-4 517 085 (EDWARDS JAMES H ET AL) 14 May 1985 (1985-05-14)
D4: US-A-4 296 951 (ZIMMERLY ROBERT D) 27 October 1981 (1981-10-27)

1 The amendments fulfill the requirements of Article 34(2) b) PCT.

2 Article 33(2) PCT

2.1 **Claim 1** defines a filter assembly defined by the following technical features:

- i) a housing,
- ii) one or more spiral wound membrane module which is open for the entrance of retentate from the front wall as well as from the tangential ends of the retentate channels and
- iii) anti telescoping devices upstreams and downstreams of each module.

Further, the following functional features are defined:

- iv) free flow of fluid at the entrance to space between i) and ii);
- v) restricted flow of fluid at the outlet of space between i) and ii);
- vi) the pressure in the retentate channels is equal or lower than the pressure in the space between i) and ii).

Non of the documents D2-D4 is disclosing features iv), v) and iv). In consequence, the subject matter of claim 1 fulfills the requirements of Article 33(2) PCT. However, reference is made to item 5) concerning late published document D1.

2.2 The subject matter of **claim 11** is an anti telescoping device (iii) allowing to fulfil the functional features iv)-vi) of a filter assembly as defined in claim 1. In addition the following technical features are disclosed:

- vii) means for realising functionality v)
- viii) means for realising functionality iv)

ix) means for restricting the flow to the inlet of the retentate channels.
This feature is not disclosed in documents D1-D4, thus the requirements of Article 33(2) PCT are fulfilled.

2.3 Claim 6 defines a method of use of the filter assembly which also fulfills the requirements of Article 33(2) PCT.

3 Inventive step (Article 33(3) PCT)

The technical effect represented by functional feature vi) is achieved due to three essential technical features incorporated into the anti telescoping devices of the filter assembly which are not disclosed in prior art documents D2-D4:

- a) feature viii),
- b) **ring** abutting to the outlet side of space between i) and ii) (feature vii) of claim 11) and
- c) **flow restrictor** placed upstreams of the inlet of the retentate channels (feature ix) of claim 11).

Two embodiments of the anti telescoping device are disclosed:

- I) Features a)/b) and c) in two separate parts joined together (cf. fig. 6).
- II) Features a)/b) and c) in one integral part (fig. 10).

The problem to be solved is to prevent the unwinding of the spiral wound modules during operation under a feed pressure and at the same time to improve the driving force through the module.

The solution to the problem is achieved due to the combination of features a), b) and c).

The effect of combined features a) and b) is, that in the space between i) and ii) a pressure equal or higher than in the retentate channels. Thus, unwinding cannot occur.

The effect of feature c) is a reduction of the pressure in the retentate channels further increasing the pressure difference between the space between i) and ii) and the retentate channels and thus increasing the driving force for the liquid flow in radial direction towards the centre of the module.

The features are neither known nor obvious from the prior art documents D2-D4. Thus the presence of an inventive step according to Article 33(3) PCT is acknowledged for **claims 1-11**.

4 Clarity deficiencies (Article 6 PCT)

4.1 In **claim 1** it is not the "filter elements" but the anti telescoping devices which "are provided with means for securing...".

4.2 Since independent **claim 1** does not disclose technical features a), b) and c), it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention. Further functional feature ix) is not disclosed in claim 1.

4.3 For reasons of consistency of the wording the feature ix) of claim 11 should be amended to "flow restrictor".

4.4 **Fig. 5** does not represent an embodiment according to the invention as it does not comprise feature c).

5 Further documents considered to be relevant

In regional phases the document D1 published before the filing date of the application may be relevant for the discussion of novelty for the following reasons:

D1 addresses the same problem (p. 3, l. 5-8) and solves it by the features i) to viii), namely a fluid-tight sealing (fig. 1, ref. 39) of the gaps (49, 50, 51) passageway as part of the ATD members (downstream of the filter elements) therefore maintaining a zero or positive pressure difference between gap and retentate interior of the filter elements. The arguments of the applicant referring to the figure of Annex 2 with letter from 18.12.03 are thus not convincing. This figure corresponds to fig. 5 of the application. With respect to novelty, D1 thus may be relevant for claims 1, 2 and 5-10.

A "flow restrictor" (feature ix)) according to claim 3 or 11 (cf. also to annex 1 in the letter of 18.12.03) is not disclosed in D1.

P A T E N T C L A I M S

1. Filter assembly for ultrafiltration comprising in a pressure vessel one or more filter elements
5 with antitelescoping devices (ATD) located upstreams and downstreams for each filter element, wherein the filter elements comprises one or more membranes, each consisting of a central permeate spacer covered on both sides by separating membranes, connected at one
10 edge with a permeate pipe and blocked at the three other edges, wound around a central permeate pipe with a concentrate spacer allowing fluid from the space between the wound filter element and the pressure vessel to flow into the wound filter element in
15 a direction tangential to the cross-section of the filter element, so that the membranes and concentrate spacers are lying alternating in the wound element; and wherein the inlet to the space between the wound filter element and the pressure vessel is free and
20 the outlet from said space is restricted so that no flow or only a limited flow is allowed from said space to the space after the respective wound filter element c h a r a c t e r i z e d in that, the wound filter elements are provided with means for securing
25 that the pressure inside the retentate channels of the filter element is equal to or lower than the pressure in the space between the filter element and the pressure vessel at the same longitudinal position over the whole length of the element.

30

2. Filter assembly according to claim 1, wherein the ATD is formed having a ring abutting to the outlet side of the wound filter element preventing fluid flowing out from the filter element in a
35 distance from the central permeate pipe higher than d, where d is a distance smaller than the radius of the spiral wound membrane element.

3. Filter assembly according to claim 1 or 2, wherein the means for securing that the pressure at the inlet of the filter element is equal to or lower
5 that the pressure in the space between the filter element and the pressure vessel at the same longitudinal position is a flow restrictor placed at the inlet to the spiral wound filter element.

10 4. Filter assembly according to claim 3, wherein the flow restrictor is made in one piece with the ATD.

5. Filter assembly according to any of claims
15 1-4, wherein the concentrate spacers are protruding from the separating membranes.

6. Process for ultrafiltration using a filter assembly according to any of the claims 1-5, where in
20 a cross section at any position along the filter element the pressure in the space between the filter element and the pressure vessel is at least 0.01 bar higher than the pressure inside the filter element.

25 7. Process according to claim 6, wherein the pressure difference between the inlet and the outlet of a filter element is in the range of 0.5 to 5 bar/m.

30 8. Process according to claim 7, wherein the pressure difference between the inlet and the outlet of a filter element is in the range of 1-3 bar/m.

9. Process according to claim 6 to 9, wherein
35 fluid to be filtered is an aqueous solution.

10. Process according to claim 10, wherein the fluid to be treated is milk, whey or a fermentation

broth.

11. Anti telescoping device (ATD) for use in a filter assembly according to any of claims 1-5, comprising means for securing that fluid can not or only in a limited extend flow out of the space between the proximal filter element and the pressure vessel, means for securing a free flow of the concentrate into the space between the distal filter element and the pressure vessel, and means for restricting flow of concentrate to the inlet of the distal spiral wound filter element in order to secure that the pressure at the inlet of said distal filter element is lower than the pressure in the space between the filter element and the pressure vessel at a corresponding position.